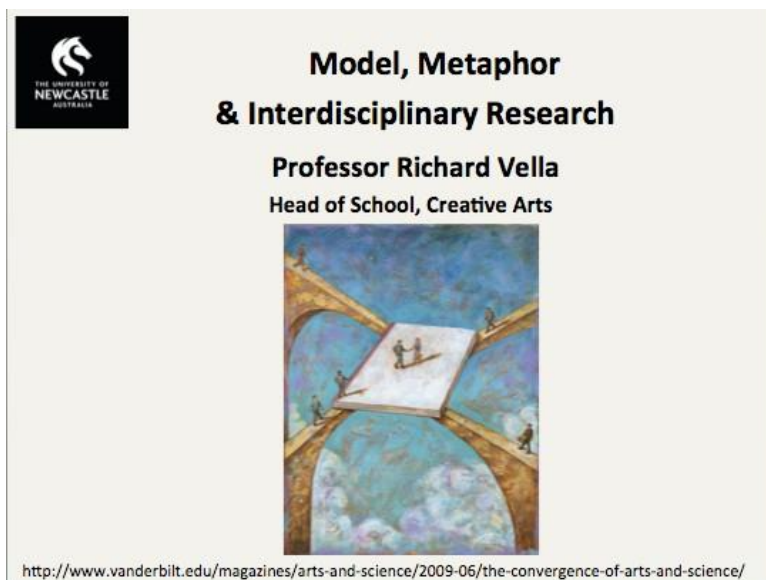


Model, Metaphor and Interdisciplinary Research

Professor Richard Vella

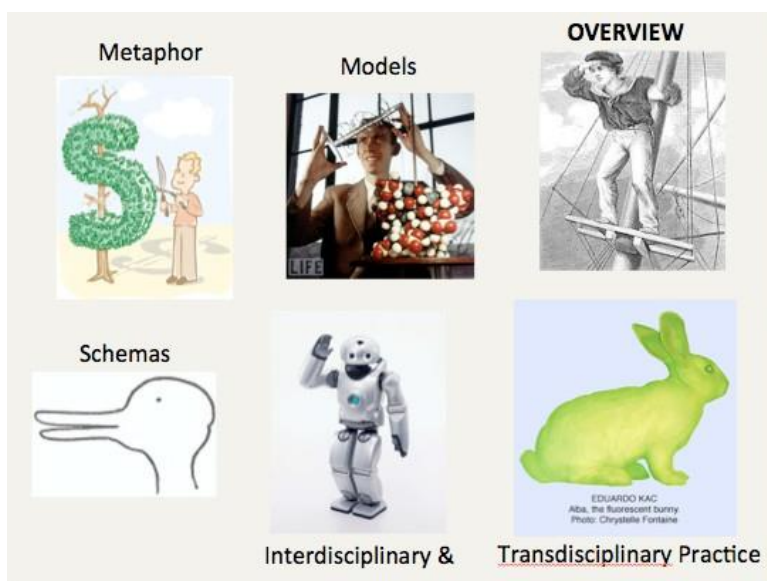
10/12/13



Introduction

This presentation outlines some of the basic principles underlying metaphor and models. For those familiar with the many nuances of metaphor I apologise if my discussion is simplistic and obvious. The overall shape of my presentation covers

- Metaphor
- Models
- Schemas
- Interdisciplinary Practice



Knowledge (what is known) needs representation which involves sound, image, text, movement or space. Both Art and Science are knowledge creation domains. It is not the case that art uses metaphor and science uses models. Both use models and metaphors to represent what is known.

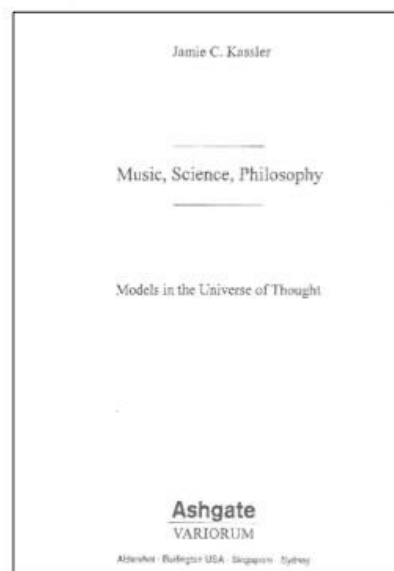
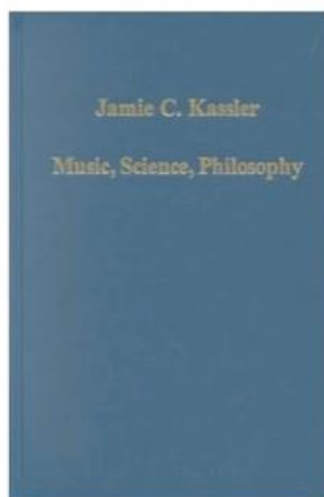
Many theories on metaphor have been written since Aristotle. I do not attempt to summarise the complex history of metaphor theory. While my presentation refers to metaphors in language, I will also refer to visual metaphors, sonic metaphors, spatial metaphors and gestural metaphors. It is their relationship to interdisciplinary research I believe underpins Arts and Science interdisciplinary research.

Firstly, I would like to start with a personal anecdote. Between 1992 and 1996 I was composer in residence within the School of Mathematics, Physics, Computer Science and Electronics at Macquarie University. At that time I wanted to develop an interdisciplinary program in music and the sciences. This resulted with music being offered to all students at Macquarie and the opportunity for interdisciplinary postgraduate study in which music could be combined with science and technology and any other area of the university such as linguistics, social sciences or politics. In that short time, there were many successes such as the awarding of a PHD in electronics to a student who used his computer music compositions to research high speed communication networks and protocols.


I was viewed with much suspicion from the scientists. Many thought I was going to take away their funding. When asked why I was in a science school I responded “because you are just as creative as I am”. This always worked because at the heart of the Macquarie project was the relationship between model, metaphor and creative thinking.

Part One: The work of Jamie Croy Kassler


My investigations were initially inspired by the writings of American musicologist Dr Jamie Croy Kassler who moved to Australia in the 1980s. Her formidable output historically traces the close relationship music and science have had with each other.



Researching the writings from scientists and writers such as Thomas Hobbes, Roger North, Blaise Pascal and William Harvey to name a few, and as well as going far back to the ancient quadrivium, Kassler's work shows the role music has played in the construction of scientific models.



Blaise Pascal (1623- 1662)
Mathematician, physicist
and philosopher



“...man is like playing...an organ.

...an organ, but strange, shifting and changeable.

Those who only know how to play an ordinary organ would never be in tune on this one.

You have to know where the keys are.”

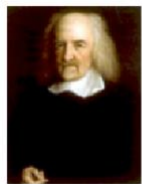
B. Pascal, *Pensées* (c. 1659, III.1 1 1)

The following quote by Pascal (1623 – 62) is one such example where he uses the organ as a metaphor for the human condition.

We think playing upon man is like playing an ordinary organ. It is indeed an organ, but strange, shifting and changeable. Those who only know how to play an ordinary organ would never be in tune on this one. You have to know where the keys are. B. Pascal, ‘Pensées’ (c. 1659, III.1 1 1)

Kassler in one chapter of her book discusses a debate in the 17th century between Thomas Hobbes and Robert Boyle on the origin of mechanics. The natural philosopher Thomas Hobbes used the renaissance instrument the lute as one reference point for his theories on resistance and elastic substances that vibrate (Kassler p 86).

17th Century Mechanics and Music



Thomas Hobbes (1588-1679)



Robert Boyle (1627 -1691)



Robert Hooke (1635 -1703)



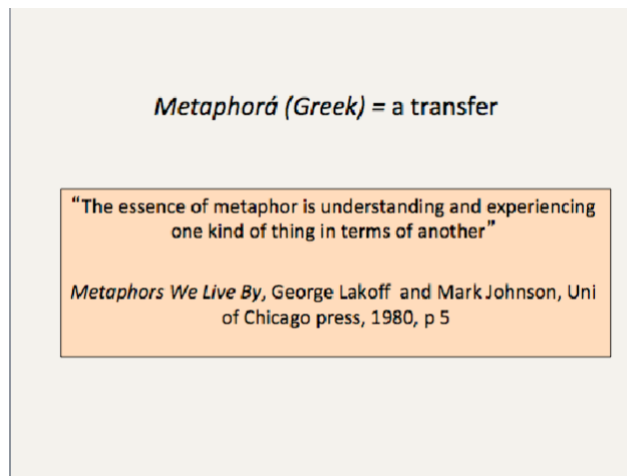
Hobbes' continuum theory was rejected by Robert Boyle in favour of an emission theory where force was conceived as a pressure. However Robert Hooke in picking up from Hobbes also referred to musical strings to understand the elasticity of bodies (Kassler p 120). The significance of this historical diversion is important as it is one example showing the role music had in the construction of models in 17th century science.

Part Two: Metaphor

The Greek word *metaphorá* literally means 'a transfer' and it is in the transfer from one domain to another that underpins the construction of a model or metaphor. Lakoff and Johnson succinctly summarise this relationship as:

The essence of metaphor is understanding and experiencing one kind of thing in terms of another

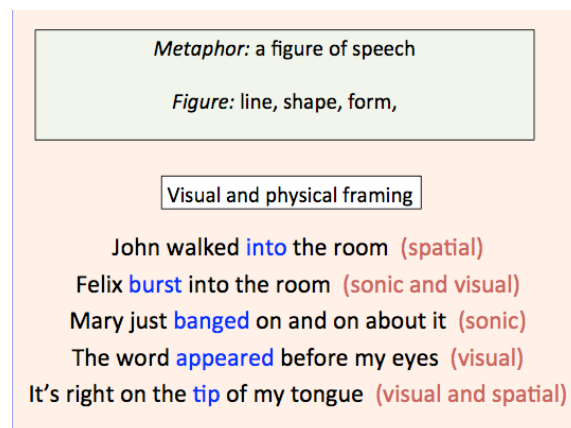
'Metaphors We Live By', George Lakoff and Mark Johnson, p 5



The key phrase in this definition is 'understanding and experiencing' and it is here I would like to restate that metaphors can be textual, visual, sonic, gestural, spatial or in combination. What is interesting is the meaning of the word 'transfer'. Transfer means to move from place to another.

There are two implications: spatial and visual (Ricoeur *The Rule of Metaphor*, 168).

For example, the phrase "at the back of my mind" refers to space and for something to be at the back of my mind means there is a visual object.



Even the traditional definition of metaphor being a 'figure of speech' is metaphorically visual. Apart from being a visual representation of a number a figure has line, form and shape.

Metaphors enable us to transfer physical and spatial understandings via speech.

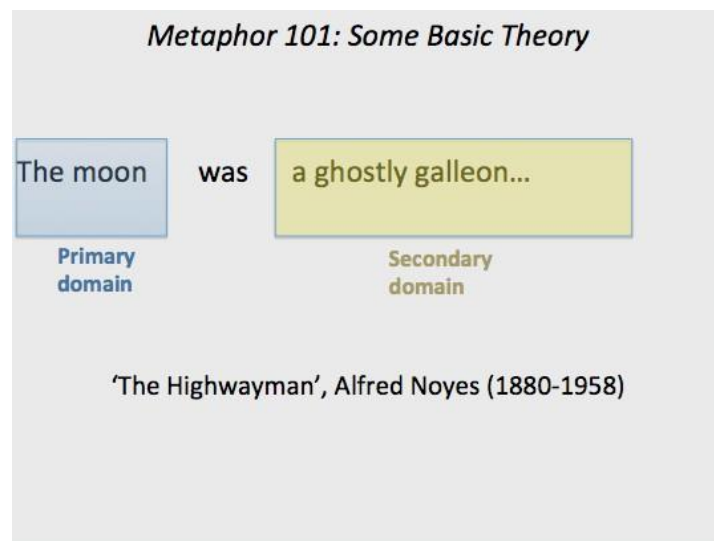
This not only happens visually and spatially but also sonically with 'onomatopoeia' where sound is transferred into speech. For example:

- It's on the tip of my tongue
- John walked into the room
- Felix burst into the room
- Mary just banged on and on about it
- The word appeared before my eyes

This very brief and simplistic overview demonstrates the intricate relationship between metaphor and the sensory. The visual, sonic and spatial motifs will be picked up later but suffice to say they are crucial to role of metaphor in the understanding of interdisciplinary practice.

Metaphor 101: Primary and Secondary domains



There are many theories on the way a metaphor operates. I shall only mention a few. In his book 'Models and Metaphors', Max Black (1962) revolutionized the understanding of metaphor by proposing an alternative to the comparative theory in favour of metaphor as an interaction.



In the comparative metaphor something is used to describe something else when a literal explanation is not used. If I say Socrates is a pig, this would be true if Socrates was the name of my pet pig. The predicate logically follows the subject.

The Comparative metaphor

Socrates (Subject) is a Pig (Predicate) : **S is P**

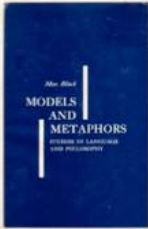
If Socrates is my pet pig this would be literal
S=P

If Socrates the person behaves like a pig,
the metaphor is comparative, **S** is mapped onto **P**
S → P

However if I am referring to Socrates a person behaving like a pig, the metaphor is comparative. The reader projects or maps the primary domain Socrates onto their understanding of a pig (secondary domain).

Black suggests that when the statement cannot be described literally the comparative approach is decorative (p 34). Socrates is like a pig. It is this decorative approach that elicits disapproval from scientists.


Max Black's Interactive metaphor



*Models and Metaphors,
Studies in language
and Philosophy*
Max Black,
Cornell University
Press, 1962

Socrates (1st domain) is a Pig (2nd domain)
S is P

Some of the behaviours of Socrates and pigs
are merged resulting with a tension between
S and P that we have to resolve.
S ↔ P = S



Black defines the relationship between the primary and secondary domains as being one of interaction. We are forced to create a connection between two separate domains in which both sides are forced to fit in or accommodate with each other.

The interactive metaphor is fundamentally a creative act. Meaning is created through the embracing of difference. The greater the difference, the more creative the metaphor.

Some of the behaviours of Socrates and pigs are merged to create a new subject where the predicate refers back to the subject resulting with a tension between S and P that we have to resolve into a new conceptual identity.

$$S \leftarrow \leftrightarrow \rightarrow P = S$$

Advertising has used Black's interactive metaphor *par excellence* where images, sounds and words are mixed to create conceptual understandings that would take a book chapter or essay to explain.

Art: the Creative Metaphor as Interactive metaphor



Everyday Objects,
Thomas Keeley.





Micro-cosm
Woo Choi

<http://www.youtube.com/watch?v=HMN7-aJlyY>

...providing new insight, through designating a unique, extralinguistic and extraconceptual referent that had no place in the intelligible world before the metaphor was articulated.

Metaphor and Art, Interactionism and reference in the verbal and nonverbal arts, Cambridge University Press, 1989, p 94 Carl R. Hausman

A reinterpretation of Black's interactive metaphor is the creative metaphor. Carl Hausman in his book on *Metaphor and Art* defines a creative metaphor as:

“a metaphorical expression....providing new insight, through designating a unique, extralinguistic and extraconceptual referent that had no place in the intelligible world before the metaphor was articulated.”

Metaphor and Art, Interactionism and reference in the verbal and nonverbal arts,
Carl R. Hausman, Cambridge University Press, 1989, p 94

For Hausman the creative metaphor is fundamentally phenomenological. The more disparate the references the more challenging or confounding. The creative metaphor merges contradictory or sensory experiences where the perceiver is forced to create a connection based on their own experiences.

These connections can be provocative such as some examples of bioart or to refer to Deleuze, cause an 'affect' where the perceiver is presented with something that is un--representable. In these metaphors the interaction is irreconcilable, demanding discussion debate or investigation, or at times problematic.

Conceptual Metaphor

Black also discusses metaphor as archetype where the metaphor refers to a repertoire of ideas associated around a particular domain (p 241). Mathematics is one example when it uses the archetype of space with terms such as limit, as X approaches Y or specific points on a plane.

Conceptual Metaphor
A cluster or network of metaphors grouped within a conceptual framework

Conceptual framework: Ideas are plant organisms

- His ideas have finally come to **fruition**
- That's a **budding** story
- She has a **fertile** imagination
- Mathematics has many **branches**
- He has a **barren** mind
- The **seeds** of his great ideas were **planted** in his youth

Metaphors We Live By, George Lakoff and Mark Johnson, Uni of Chicago press, 1980, p 47

Lakoff and Johnson's book *Metaphors We Live by* pick up on Black's archetypal metaphor calling them a conceptual metaphor. A conceptual metaphor refers to a collection of terms all of which are related to a value system or network of terms that underpin a discourse. For example the following metaphors refer to a network of terms related to the metaphor of plant growth.

There are many types of conceptual metaphors such as Reddy's conduit metaphor where we use words such as 'in', 'out' and 'through' to express a sense of movement in relation to the topic of discussion.

- I am just not in to what you are saying
- I just couldn't get through to him
- Are you out of your mind?

Michael Reddy's Conduit Metaphor

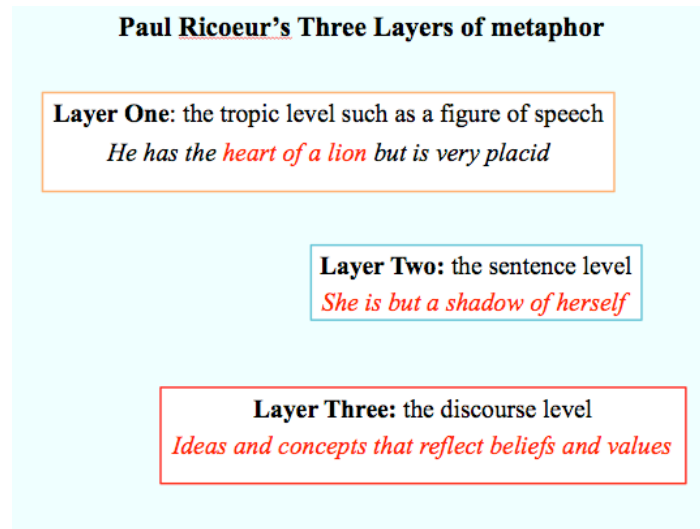
I am just not **in** to what you are saying ----->

I just couldn't get **through** to him ----->

Are you **out** of your mind? ----->

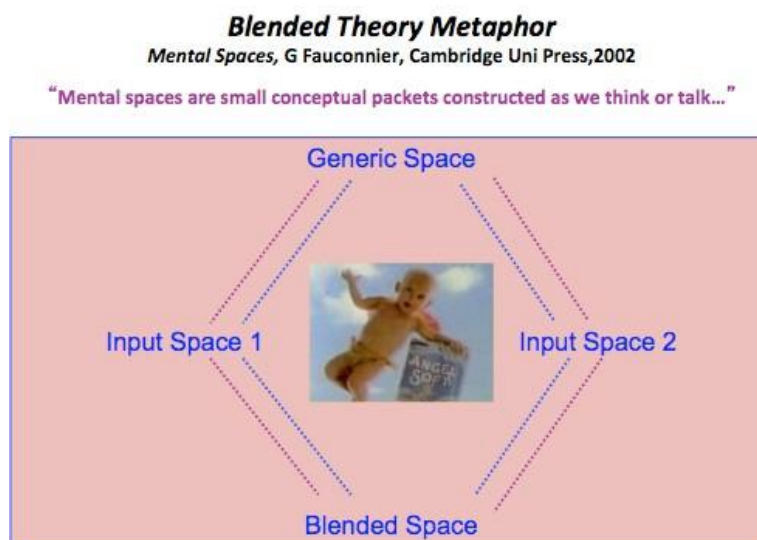
Paul Ricoeur in *The Rule of Metaphor* (1977) classifies metaphor operating on three layers:

1. the tropic level such as a figure of speech: *heart of a lion*
2. the sentence level: *he is but a shadow of herself*
3. the discourse level (values, ideas, beliefs, ethics and behaviour):



A more recent development on Lakoff and Johnson's conceptual metaphor is the Conceptual Blended Theory (BT) model by Fauconnier and Turner.

"Mental spaces are small conceptual packets constructed as we think and talk, for purposes of local understanding and action. They are interconnected, and can be modified as thought and discourse unfold." Here is the conceptual blended metaphor merged with Ricoeur's layers applied to the refugee debate to show the relationship to discourse



The asylum seeker debate can be analysed according to the blended theory metaphor as

1. the tropic level such as a figure of speech: *queue jumping*,
2. the sentence level: *Stop the boats!* Indicates a rush, an invasion
3. the discourse level (values, ideas and behaviour): Refugee's behaviour is illegal and counters our sense of decency because Australians respect boundaries. Refugees must be punished.

Blended Theory example with *illegal refugees* as metaphor

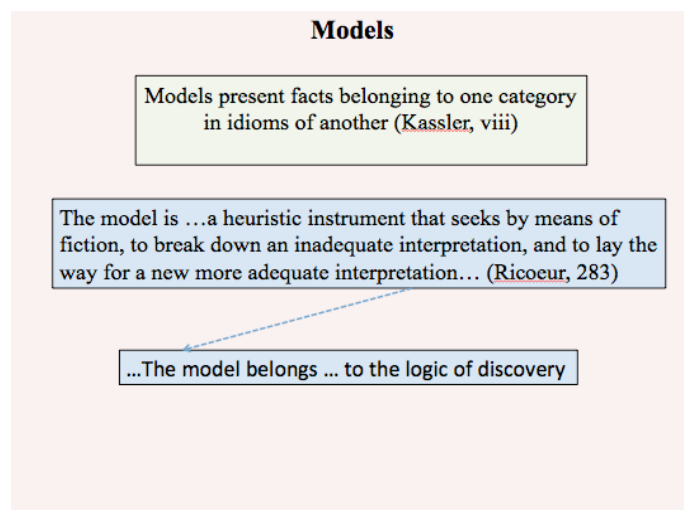
Layer One: the tropic level such as a figure of speech
queue jumping

Layer Two: the sentence level
Stop the boats!

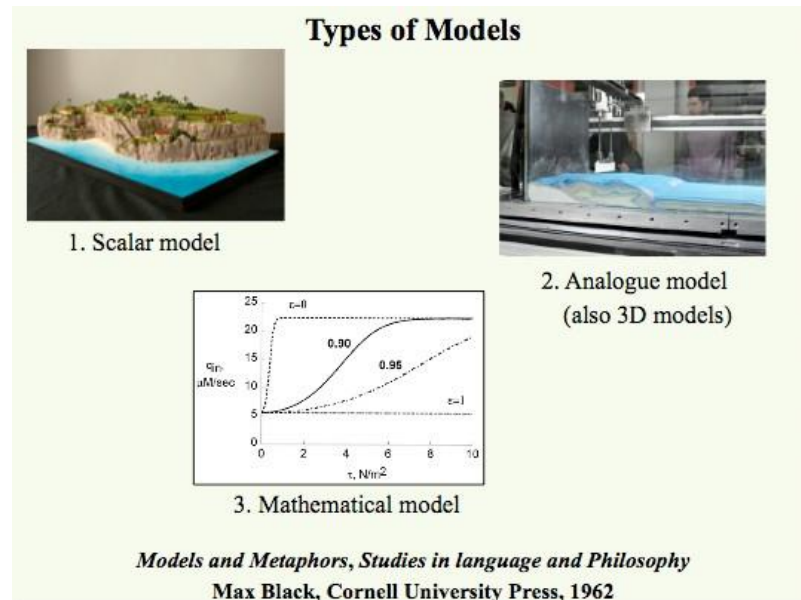
Layer Three: the discourse level
Refugee's behaviour is illegal, counters our sense of decency, Invasion, must be punished.

Part Three: Models

Models are a particular type of metaphor as can be seen with Kassler's definition. Ricoeur in writing about the work of Hesse which I will refer to later writes: *The model is a heuristic instrument that seeks by means of fiction to break down an inadequate interpretation for a more adequate interpretation.. In doing so it is a logic of discovery*



There are many types of models. Max Black in *Models and Metaphors* (1962) lists various uses of the word model: from the scalar model of a boat or aeroplane, to it being an exemplar (the perfect husband or wife), an iteration of a design series such as a new model car or computer or analogue model: a small scale scientific experiment showing how water freezes. Except for the Analogue model, Black goes on to say that these are not relevant to scientific investigation.



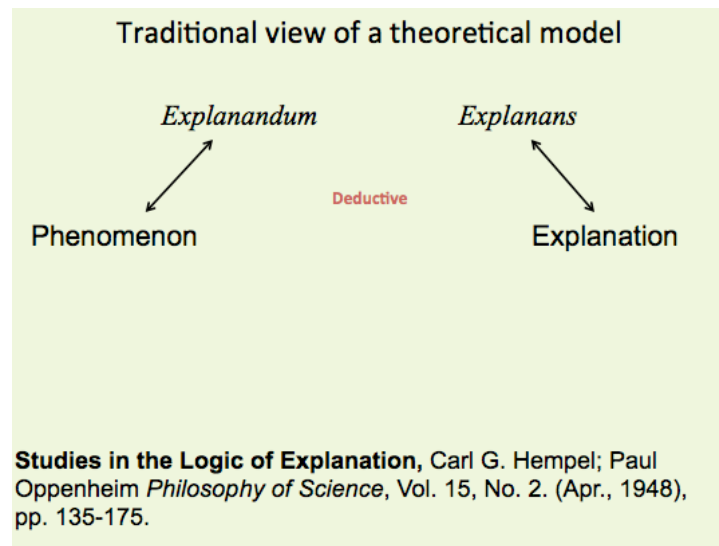
A mathematical model uses symbols to show what kinds of function would approximately fit data and how that event can be recreated. It does not explain the cause and effect of an event. There is no inference or interpretation. A theoretical model explains an event or situation. It follows certain conditions such as inference, analogy and explanation.

A model operates in exactly the same way as a metaphor but with the addition of a third parameter called the explanation domain. In metaphor our experience of the primary and secondary domains enable understanding.

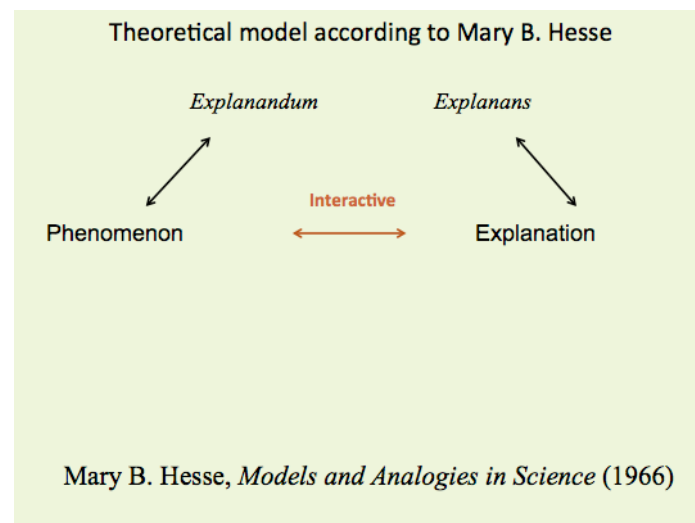
In a model the relationship between the primary and secondary domains needs an explanation. Hempel and Oppenheim(1948)¹ define a model as having the following two components:

- the *explanandum* and the *explanans*.
- The *explanandum* is the phenomena needing to be understood and explained.
- The *explanans* is the explanation of that phenomena.

¹ Studies in the Logic of Explanation, Carl G. Hempel; Paul Oppenheim
Philosophy of Science, Vol. 15, No. 2. (Apr., 1948), pp. 135-175.



In her book *Models and Analogies in Science* (1966), Mary Hesse picks up on Max Black's interactive metaphor theory by defining the relationship between the *explanandum* and *explanans* as an approximate fit. This approximate fit is dynamic. As more information is provided, the model must be updated, "re-described" as she calls it.

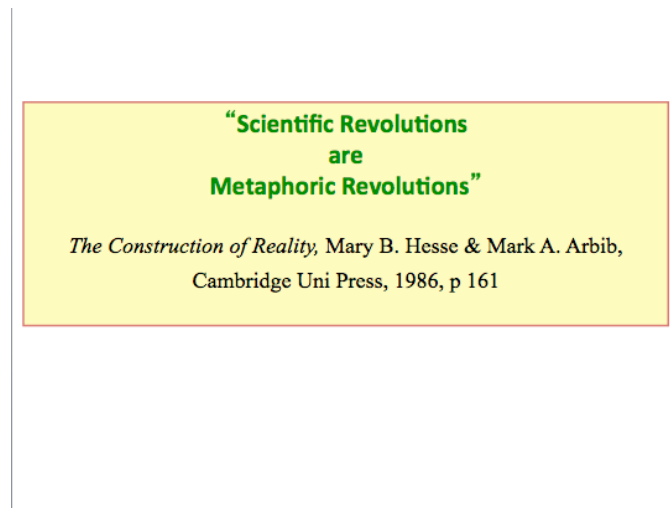


According to Hesse, a model is a process towards discovery underpinned by the "the continuous adaption of our language to our continually expanding world, and metaphor is one of the chief means by which this is accomplished"(p 177). It is here one can see how models are creative. They are not deductive but continually in flux in order to adapt to the *explanandum*.

Mary Hesse in a much later book (*The Construction of Reality*, 161) writes "Scientific revolutions are metaphoric revolutions". By this she means:

Scientific models are a prototype, philosophically speaking, for imaginative creations or schemas based on natural language and experience, but they go beyond it by metaphorical extension to construct symbolic worlds that may or may not adequately represent aspects of

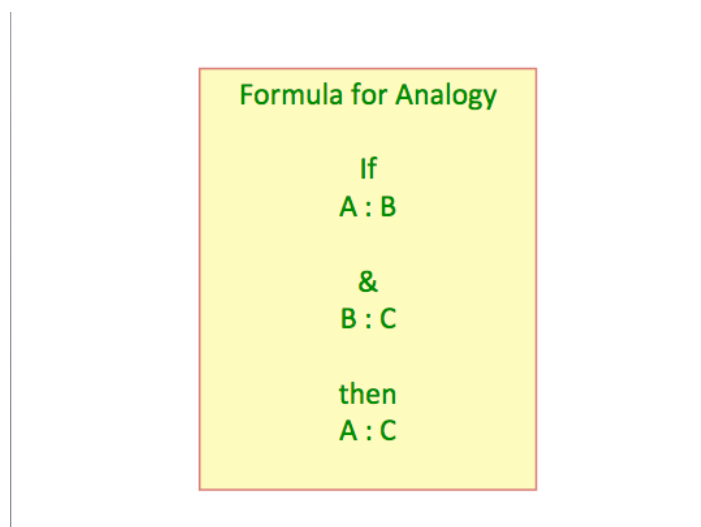
the empirical world. These symbolic worlds all share with scientific models the function of describing and redescribing the world.



Analogy is central to both model and metaphor: something is used to represent or explain something else. Ernst Rutherford’s claim in 1909 that the atom is like the solar system is one example of the use of analogy.

Such a conceptual leap requires something outside of logic while at the same time demands a rigorous logic to be plausible. It is here that metaphor as interaction enters the fray.

But there are strong and weak analogies. A strong analogy exists when there are more similarities than differences. These similarities include structural, causal, qualitative or appearance. The more correspondences the stronger the analogy. A weak analogy exists when the differences are greater than the similarities. The general formula for analogy is the following. If A : B, and B : C, then A:

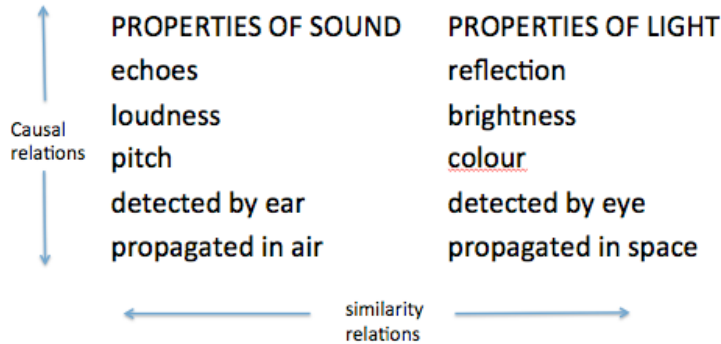


The more elements belonging to B, the stronger and plausible the analogy.

Mary B. Hesse uses the analogy between sound and light to demonstrate causal and similarity relations.

Strong analogy

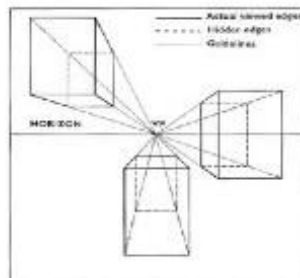
A strong analogy exists when the similarities are not based on appearance but structure, function, causality and time



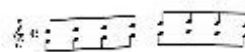
General rule: A strong analogy exists when the number of relevant similarities are greater than the differences

The model is not the province of science. In this example, the concept of perspective is represented as geometry, visually as space and musically in time.

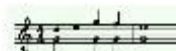
What is modelling what?



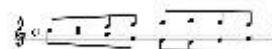
Parallel motion



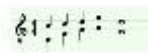
Oblique motion



Contrary motion



Similar motion



Musical space in Renaissance Counterpoint

However scientific models have their critics. The French physicist Pierre Duhem believed models should only be used sparingly and not get in the way of logic. Once the phenomena can be explained through theory then the model must be discarded. Duhem was very critical of the English school of physics which integrated models in their theory.

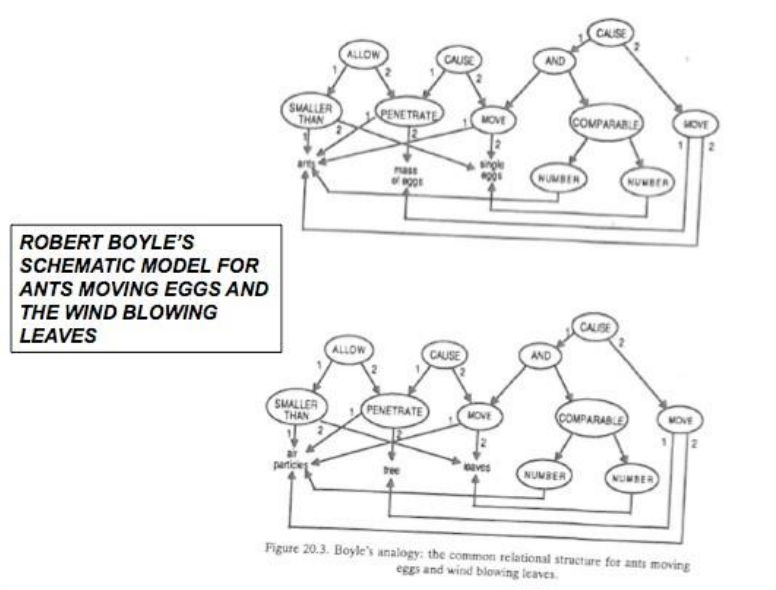


Pierre Duhem 1861-1916

Duhem critique On English Physicists use of models

- Models escape the domination of logic.
- They are designed for pleasure for the English physicist' s imagination

An example of the way the English physicists used models can be seen in Robert Boyle's air pressure model comparing the wind blowing leaves with ants moving eggs. Note the parallel structure in the schematic diagram. This conforms to Hesse's analysis where the more causal, temporal and similar relationships, the better the model.



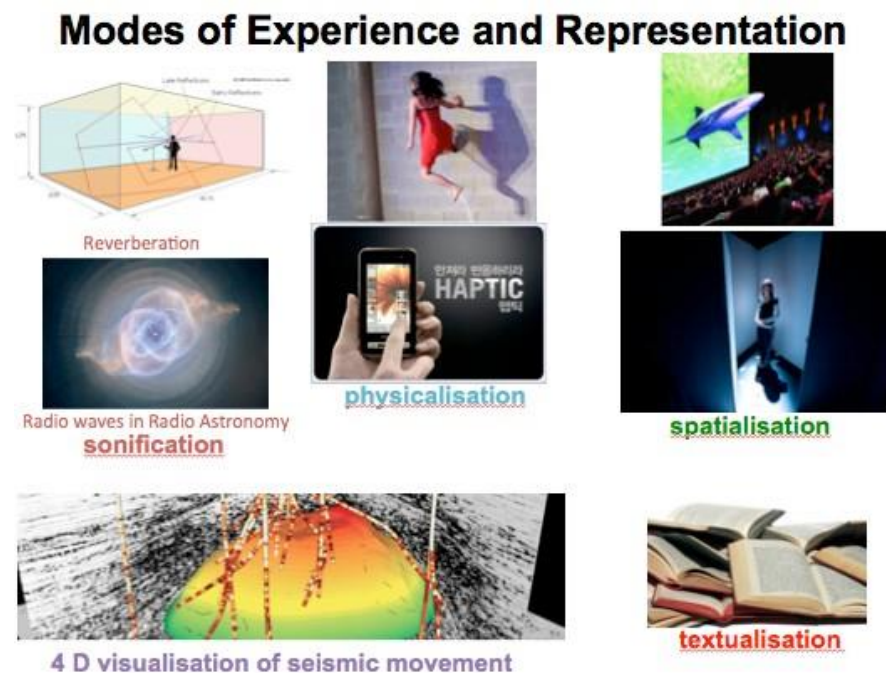
The work of Hesse and Black suggest there is more in common in the creative arts and sciences regarding theorising, experimentation and reality construction.

Part Four: Modes of representation and Schemas

All research involves the symbolic representation of knowledge. This can be in the form of schemas, formulae, designs, music score, forms and shapes etc.

As well as textualisation, both the sciences and creative arts use visualisation, sonification, spatialisation and physicalisation to experience and communicate information and knowledge.

A theatrical performance, installation or immersive cinematic work are excellent examples of representing complex non textual information that can function within a model or metaphoric discourse.



The creative arts as with other disciplines rely on these processes of representation to communicate understanding and ideas. In this way, the creative arts can be understood as an encoder and translator of information. Knowledge is translated into different representative formats and the creative arts is also an active participant in the encoding, understanding or representation of data.

Creativity, Representation and Schemas

The above quote from Hesse used the word schemas as a creative action.

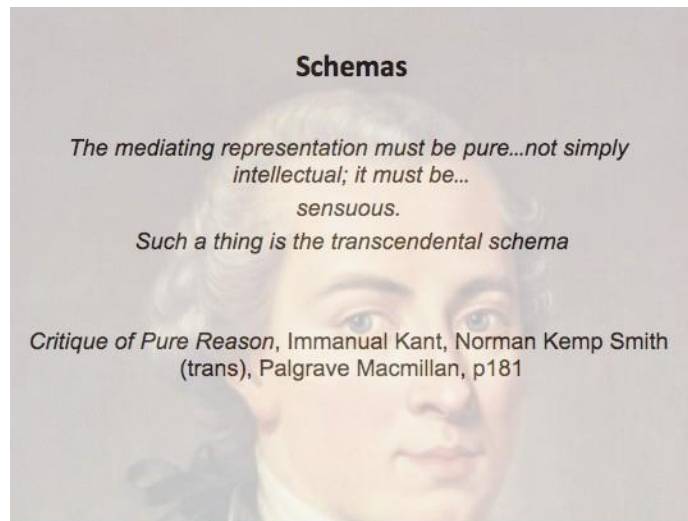
Scientific models are a prototype, philosophically speaking, for imaginative creations or schemas based on natural language and experience .

Mary B. Hesse

As soon as we have an idea, intuition and wish to express this idea we hit the brick wall of representation. We are talking here about a new idea, something we have not experienced before

and cannot rely on tried and true methods. This is the hunch, the rush of blood in our veins, that moment of epiphany we all experience when we have an insight. If we want to recreate or represent that hunch and develop it the first step will most likely involve a schema. In the words of Immanuel Kant:

The mediating representation must be pure...not simply intellectual; it must be...sensuous. Such a thing is the transcendental schema
 Critique of Pure Reason, Kant, p181

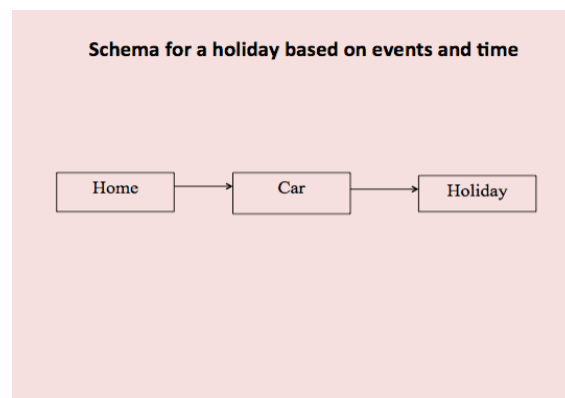


The schema is that ambiguous space between intuition and rationalisation. In following on from Kant's definition of a schema, Satre in his book *The Imaginary* writes of a schema:

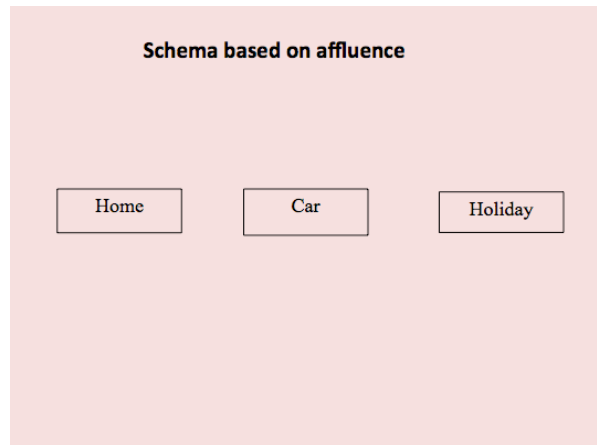
It is characteristic of the schema that it is intermediate between the image and the sign. Its matter demands to be deciphered. It aims only to present relations. By itself it is nothing...they are not signs...

The Imaginary, Jean--Paul Satre, Routledge, 2004, p 29

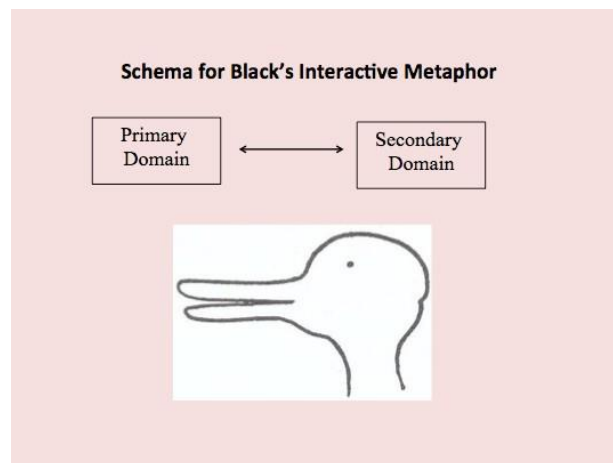
We often visualise schemas when wanting to understand a problem, sets of relationships or some deep feeling or experience. The schema tries to capture those fleeting intuitions that can be represented through a name or concept. Take for example the following schema.



Our experience gives meaning to this schema in that we infer that I leave my home to have a holiday by car. However it could also mean my assets and wealth: a house, a car and money to spend on a holiday.



Max Black's schema for the interactive metaphor shows a two way relationship between the primary and secondary domains. As Satre says, the schema is not symbolic as it is dependent on implicit information that links the concepts together. Implicit being the key word here. The schema captures the essential elements and if we wanted to go further we would need to add in more information resulting with a change of schema. This is why the ambiguous duck/rabbit schema is appropriate. If I said rabbit or shifted the schema on its side, you would look for similarities with your image of a rabbit.



The early 20th C. philosopher Ernst Cassirer who was profoundly influenced by Kant expounded a philosophy of symbolic forms that mapped myth and language and a theory of the mind.

The schema is the uniting "representation", the synthetic "medium" in which the forms of understanding and the sensuous intuitions are assimilated so that they constitute experience...The schema ...is a sensuous-intellectual form.

The Philosophy of Symbolic Forms, Ernst Cassirer, p. 13


The schema becomes “pregnant” with a potential of meanings depending on context. These new contexts become significant

The schema is the uniting 'representation',

the synthetic 'medium' in which the forms of understanding and the sensuous intuitions are assimilated so that they constitute experience...

The schema ...is a sensuous-intellectual form.

The Philosophy of Symbolic Forms. Ernst Cassirer, Vol 1, Yale University Press, p 13



Ernst Cassirer
1874 - 1945

While Cassirer’s complex understanding of consciousness cannot be adequately summed here nor criticisms of his perspective. However his work has significance to my presentation. This significance is summed up by Susanne Langar in her preface to her translation of Cassirer’s book *Language and Myth* (1946, Harper and Brothers). Langar writes:

Language, the symbolisation of thought, exhibits two entirely different modes.... one of which is discursive logic, the other creative imagination.

Human intelligence begins with conception, the prime mental activity; the process of conception always culminates in symbolic expression. *This irrational world can only be communicated by the use of signs and symbols.*

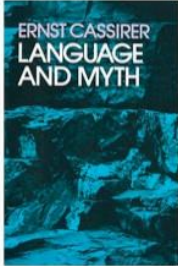
A conception is fixed and held when it has been embodied in a symbol. ... The genesis of symbolic forms – verbal, religious, artistic, mathematical, or whatever modes of expression there be – is the odyssey of the mind.

Langar *Language and Myth*, Ernst Cassier.

...the symbolisation of thought, exhibits two entirely different modes...

one of which is discursive logic,

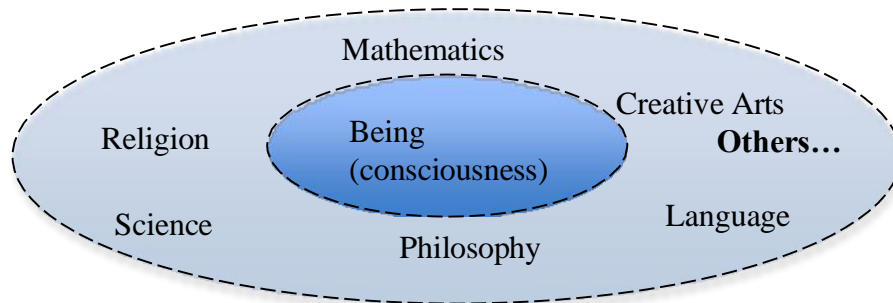
the other is the creative imagination.



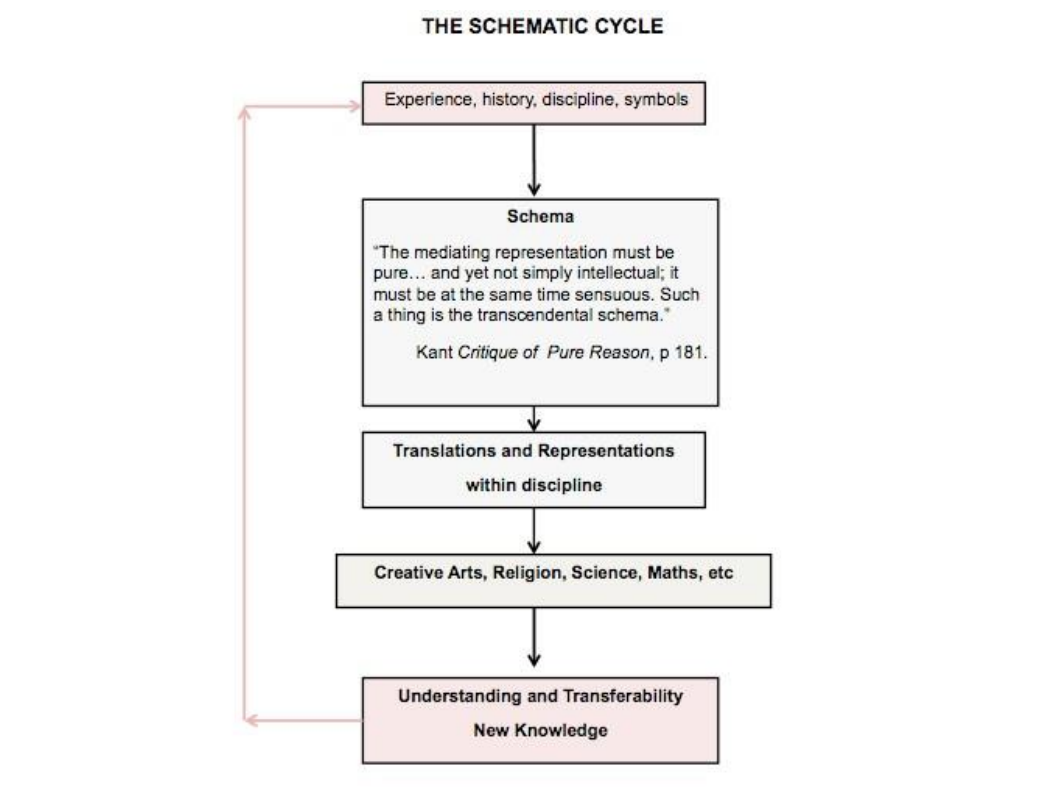
Susan Langar, Introduction to: *Language and Myth*, Ernst Cassirer, Susan Langar (trans)Dover, 1953

This creative imagination applies to the arts and sciences. Creative thinking and practice, is fundamentally sensory, responsive, intuitive. It relies on irrational logic: one full of contradictions, back--trackings, quantum leaps, etc. It is anomalous --- unable to be pigeon holed. It is an ambiguous space, one in which meanings are not so readily pinned down, when the artist hovers and enjoys the contradictions and non--logical flow of things.

In the following schema based Cassirer there is no hierarchy between science, mathematics, philosophy and works of art. Each discipline activity is a reconciliation and expression of a view of the world, of consciousness or being (Ontology). This can be simply and naively summarised



These domains of knowledge are not autonomous silos. Each knowledge domain borrows from, intersects with, models, interprets or transforms aspects of each other's domain to create meaning and understanding. It is here where we can see the relationship between schemas and models. Both are journeys of discovery, continually being redefined, continually re--describing. Referring back to Kant's schemas it is possible to see the relationship between Cassirer's rational and irrational domains and the iterative process towards symbolic representation.

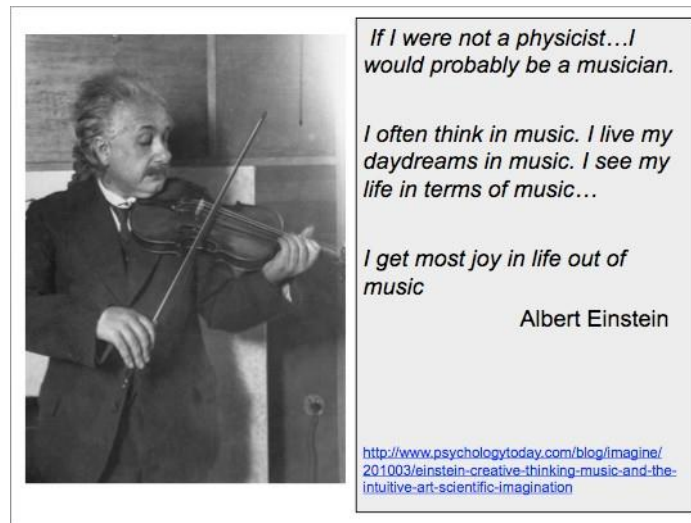


The following quote by Einstein aptly demonstrates his relationship to the intuitive and symbolic.

If I were not a physicist...I would probably be a musician. I often think in music. I live my daydreams in music. I see my life in terms of music... I get most joy in life out of music

(Calaprice, 2000, 155).

<http://www.psychologytoday.com/blog/imagine/201003/einstein-creative-thinking-music-and-the-intuitive-art-scientific-imagination>



Once the schema becomes loaded with possibilities, the necessity to fix becomes a priority. We move from the imaginary to the symbolic. This is where textualisation, visualisation, sonification, physicalisation and spatialisation enter the fray. With that in mind, the final part of my presentation will bring together metaphor, models and schemas and their relation to interdisciplinary and transdisciplinary research.

Part Five: Interdisciplinary and transdisciplinary research

Interdisciplinary and Transdisciplinary Research

Broadening the frame



Discovery = Collaboration + Schema + Metaphor and/or Model

Interdisciplinary research is often defined by metaphors such as boundary crossing, mapping or bridge building to describe itself. Julie Thompson Klein in her ground breaking book *Interdisciplinarity: History, Theory, & Practice*, Wayne State University Press, 1990 devotes a whole chapter to the various metaphors used for interdisciplinary research and their limitations. I will not be covering that chartered territory.

The claim I am making is that new exciting collaborations and outcomes can be discovered once metaphors, models and schemas are in alignment. The collaborators share the same vocabulary.

The three basic uses of the word interdisciplinary can be summed up in three groups: multidisciplinary, interdisciplinary and transdisciplinary. Unfortunately there is not commonality in their definitions as can be seen with the following two tables. Multidisciplinary does not automatically suggest integration of any sort. It usually means each discipline while working together, do not cross boundaries to solve a problem.

Lattuca² defines four categories:

1. *Informed Disciplinarity* may use examples from other disciplines but the focus is still discipline centric.
2. *Synthetic Interdisciplinarity* the linking issues are of two subtypes: issues or questions that are found in intersections of or gaps among disciplines. In either case, the identity of the discipline is still in tact. For example an examination on the impact of Arts funding policy on new creative work.
3. *Transdisciplinarity* “is the application of theories, concepts or methods across disciplines with the intent of developing an overarching synthesis” The disciplines subordinate to a super--discipline.
4. *Conceptual Interdisciplinarity* “includes issues and questions without a compelling disciplinary basis”. Postmodern criticism is one example of conceptual interdisciplinarity

<i>Informed Disciplinarity</i>
Disciplinary questions requiring outreach to other disciplines
<i>Synthetic Interdisciplinarity</i>
Questions that link disciplines
<i>Transdisciplinarity</i>
Questions that cross disciplines
<i>Conceptual Interdisciplinarity</i>
Questions without a compelling disciplinary basis
<small><i>Creating Interdisciplinarity: Interdisciplinary Research and Teaching among College and University Faculty</i>, Lisa Lattuca, Vanderbilt Uni Press</small>

² *Creating Interdisciplinarity: Interdisciplinary Research and Teaching among College and University Faculty*, Lisa Lattuca, Vanderbilt Uni Press p 83

Rosenfeld is more general and more strict in the three definitions.

Rosenfeld PL. *The Potential of Transdisciplinary Research for Sustaining and Extending Linkages between the Health and Social Sciences*. *Social Science & Medicine*. 1992;35(11):1343–57. [PubMed]

Multidisciplinary: teams work in parallel or sequentially from their specific disciplinary base to address a common problem

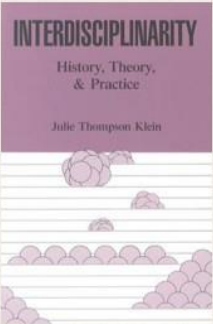
Interdisciplinary: teams work jointly but still from a discipline-specific base to address a common problem

Transdisciplinary: teams work using a shared conceptual framework, drawing together discipline-specific theories, concepts, and approaches to address a common problem

The fundamental issues in any interdisciplinarity of these are communication and understanding. Implicit is time and the willingness to take risks. The limitations that occur that inhibit sustainable interdisciplinary cultures is aptly listed by Sverre Sjölander who identifies ten stages towards achieving an interdisciplinary culture.

1. Singing the old songs
2. They on the other sides are all idiots
3. Retreating into abstraction
4. Definition sickness
5. Fruitful discussion
6. The glass bead game
7. Great failure
8. What is happening to me?
9. Getting to know the enemy
10. The real beginning

10 Stages towards Interdisciplinarity

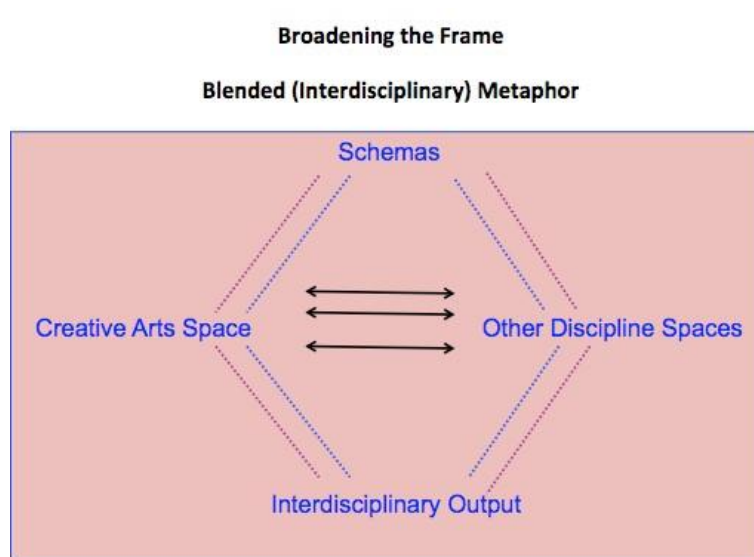


1. Singing the old songs
2. They on the other sides are all idiots
3. Retreating into abstraction
4. Definition sickness
5. Fruitful discussion
6. The glass bead game
7. Great failure
8. What is happening to me?
9. Getting to know the enemy
10. The real beginning

Sverre Sjölander in *Interdisciplinarity: History Theory & Practice*, Julie Thompson Klein, Wayne State Uni Press, 1990 p 71.

Although colloquially written notice how language and vocabulary are implicit with the words singing, songs, definition, discussion, getting to know. True interdisciplinary or transdisciplinary practice begins at stage 10, “the real beginning”. This is when vocabularies, reference points, blended metaphors, conceptual frameworks, models and even myths are shared and provide the basis for any imaginary and creative schema.

We can schematise this by using the Conceptual Blended Theory Metaphor schema. Here the disciplines interact with each other through the sharing of creative schemas and their associated metaphors. There is no need to monitor the collaboration or define the output as it is a fluid discourse (note the flow conceptual metaphor) based on common purpose, trust, discovery and risk.



A discourse based interactivity and shared conceptual frameworks as suggested by Hesse’s interactive model and Lakoff’s conceptual metaphor lie at the basis of interdisciplinary cultures

It is somewhat strange that throughout history there have been innovative cultures exemplifying this interdisciplinary approach but still there seems to be a resistance to it being the norm. Instead we revere those cultures such as Google, MIT, the Betchley Park code breakers of WW2, or the Renaissance.

In actual fact, we are interdisciplinary every time we speak and write. At the very crux is metaphor and it is the spoken metaphor *par excellence* that is interdisciplinary with its interactive use of word, image, sound, gesture or space. Metaphor and all its representations have taught us to be interdisciplinary from the very start

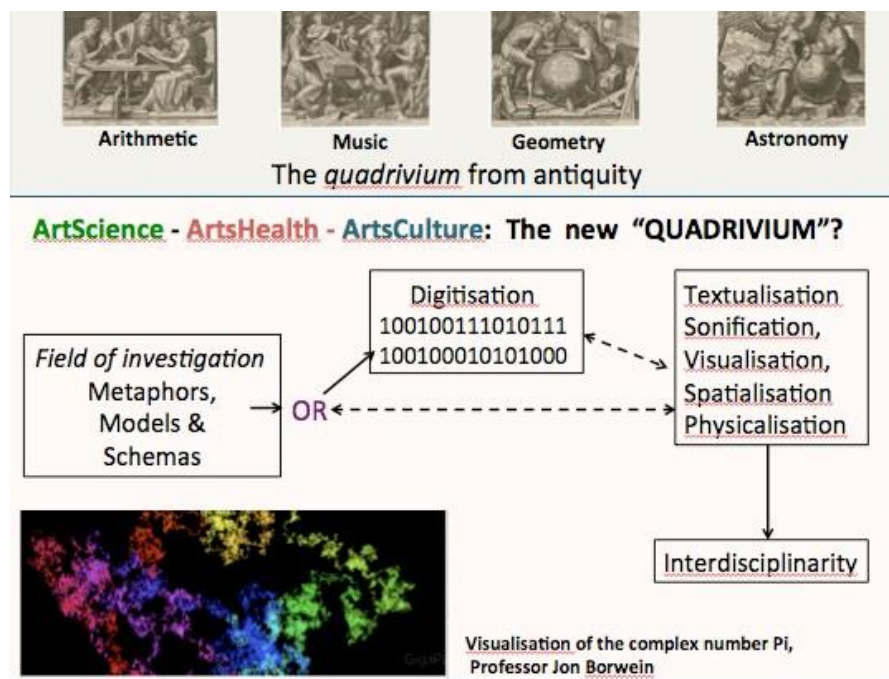
Part Six: The interdisciplinary vocabulary

Both science and the arts lead to discovery. In order for models and metaphors to be of value we must be ever vigilant to make sure they are an *appropriate fit* as Mary B. Hesse states. This appropriate fit is continually updated and re-described once new information is added.

For an ArtsScience nexus to be achieved, communication must be two way. The metaphoric discourse must operate on all levels and be continually updated with new schemas that combine all the disciplines involved.

The Quadrivium of Greek Antiquity was another exulted interdisciplinary discourse. Arithmetic, music (be default the arts), Geometry and Astronomy were grouped together under the general category called the mechanical arts. Its fundamental modus operandi was analogy which at times spectacularly failed because it viewed the real as ratios. Unfortunately irrational numbers messed that up.

Without wishing to sound romantic or nostalgic, it may be we are in a new type of quadrivium where we are seeing terms such as Artscience, Artshealth and Arts and Culture.



Instead of analogy driving the fields of investigation, contemporary metaphoric discourse underpins an interdisciplinary culture. This is where values, ethics, technology are all in the mix.

Much of this has been driven by the computer where through digitisation all disciplines are reduced to ones and zeros. But it does not always need to be digitisation. An interdisciplinary output will include visualisation, textualisation, sonification, spatialisation and physicalisation digitally or not. It is the sharing of imagination that will produce an ArtScience nexus, or for that matter, any interdisciplinary nexus.

Wilson categorises four areas where the ArtScience nexus meets. It is possible to see how this presentation on metaphors and schemas can be mapped onto the four categories. For example Incidental use of technology can be associated with Carl Hausman's creative metaphor.

Art-Science categories (Stephen Wilson)

Exploration: developing alternate or existing research agendas and technologies

Cultural implications: use of technology to explore narratives and/or conceptual frameworks

Unrelated themes: use of technology to explore themes unrelated to the technology used

Incidental use of technology: use of materials for their aesthetic beauty alone

Information Arts: Intersections of Art Science and Technology, Stephen Wilson
Cambridge: MIT Press, 2002. Quoted in *Context Providers, Conditions of Meaning in Media Arts*, Lovejoy, Paul & Vesna, Uni of Chicago Press, 2011, p 272.

The relationship between art and science can best be observed in the following quote from John L. Hennessy, President, Stanford University who understands the relationship between the creative arts and other university knowledge discourses.

“The arts can help us break out of traditional patterns of thinking and adopt fresh approaches to intellectual experiences. From an interdisciplinary perspective, this can produce new models of understanding and research not only in the science and technology, but also in the creation of exciting new art works based on this research”

<http://news.stanford.edu/news/2006/april26/hentext--042606.html>